



Calculus 2 Hints and Tips 2020 / 2021 (Relevant questions indicated below)

Q1, Q2 (a), Q5

Differentiation

Differentiation Rules – Page 25 of the tables

Note: Get used to looking for formulae in your tables. They contain lots of useful information that will help you get marks and knowing where to look will save you time in the exam!!!

| <u>Function</u> | <u>Derivative</u> |
|-----------------|-------------------|
| $f(x)$ | $f'(x)$ |
| x^n | nx^{n-1} |
| $\ln(x)$ | $\frac{1}{x}$ |
| e^x | e^x |
| e^{ax} | ae^{ax} |
| $\cos x$ | $-\sin x$ |
| $\sin x$ | $\cos x$ |
| $\tan x$ | $\sec^2 x$ |

Product Rule

$$y = uv$$

$$\frac{dy}{dx} = u \frac{dv}{dx} + v \frac{du}{dx}$$

When you have a function **multiplied by** a function

Chain Rule

$$f(x) = u(v(x))$$

$$f'(x) = \frac{du}{dv} * \frac{dv}{dx}$$

When you have a function **within** a function



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Q5

Maximums and Minimums

The value of x for which $f'(x) = 0$, identifies either a maximum or a minimum point on a curve.

(i.e. the slope of the tangent to the curve at that point is 0)

In order to determine if it's a maximum or a minimum, we look at the rate of change of the slope of the curve.

$$f''(x) > 0 \implies \text{Minimum turning point}$$

$$f''(x) < 0 \implies \text{Maximum turning point}$$

$f''(x) = 0$ then test is inconclusive

Q2 (b)

Inflection Points

The value x is the x -co-ordinate of an inflection point of the function f if

$$f''(x)=0$$

Q4, Q7

Integration

$$\int x^a dx = \frac{x^{a+1}}{a+1} + C \quad (\text{for } a \neq -1)$$

$$\int \frac{1}{x} dx = \ln|x| + C$$

$$\int \sin x dx = -\cos x + C$$

$$\int \cos x dx = \sin x + C$$

$$\int \tan x dx = -\ln|\cos x| + C = \ln|\sec x| + C$$

$$\int e^{ax} dx = \frac{1}{a}e^{ax} + C$$



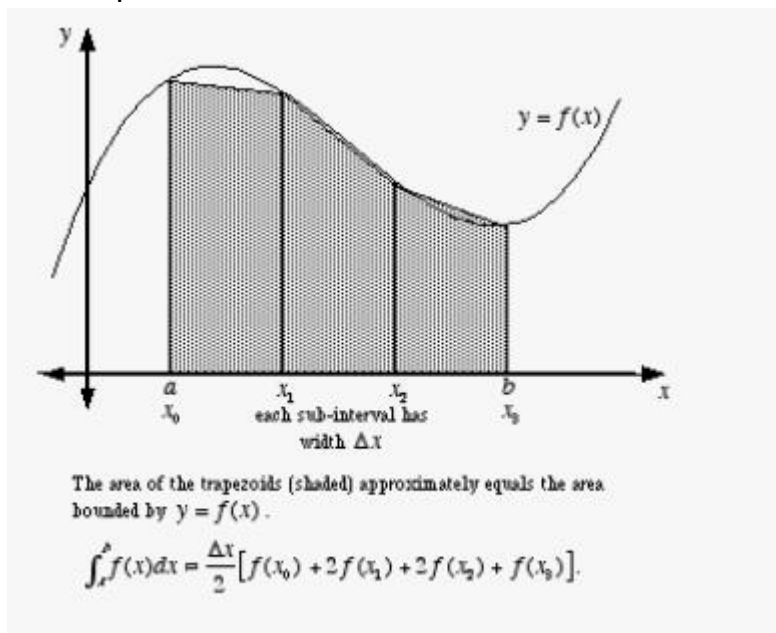
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Q3

Trapezoidal Rule

$$\int_a^b f(x) dx \equiv A = \frac{h}{2} [y_1 + y_n + 2(y_2 + y_3 + \dots + y_{n-1})]$$

The trapezoidal rule can be visualised as shown here:



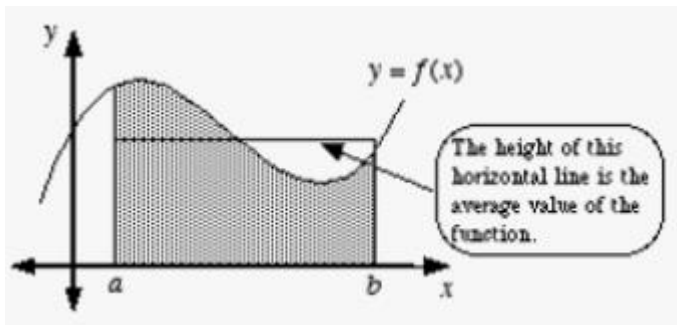


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Q4 (b) (ii), Q6 (b) (ii)

Average Height of a function f over the interval $[a,b]$

$$\text{Average value: } \frac{1}{b-a} \int_a^b f(x) dx$$



The rectangle has the same area as the shaded region under the curve.

Q6

Volume of a Sphere with radius r

$$v = \frac{4}{3} \pi r^3$$

Surface Area of a Sphere with radius r

$$a = 4\pi r^2$$